

GIBSON, DUNN & CRUTCHER LLP  
LAWYERS

A REGISTERED LIMITED LIABILITY PARTNERSHIP  
INCLUDING PROFESSIONAL CORPORATIONS

1050 CONNECTICUT AVENUE, N.W.  
WASHINGTON, D.C. 20036-5306

(202) 955-8500

TELEX: 197659 GIBTRASK WSH

FACSIMILE: (202) 467-0539

JAS. A. GIBSON, 1852-1922  
W. E. DUNN, 1861-1925  
ALBERT CRUTCHER, 1860-1931

DOCKET FILE COPY ORIGINAL

NEW YORK  
200 PARK AVENUE  
NEW YORK, NEW YORK 10166-0193

PARIS  
104 AVENUE RAYMOND POINCARÉ  
75116 PARIS, FRANCE

LONDON  
30/35 PALL MALL  
LONDON SW1Y 5LP

HONG KONG  
10TH FLOOR, TWO PACIFIC PLACE  
88 QUEENSWAY  
HONG KONG

AFFILIATED SAUDI ARABIA OFFICE  
JARIR PLAZA, OLAYA STREET  
P.O. BOX 15870  
RIYADH 11454, SAUDI ARABIA

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Federal Communications Commission  
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LOS ANGELES  
333 SOUTH GRAND AVENUE  
LOS ANGELES, CALIFORNIA 90071-3197

CENTURY CITY  
2029 CENTURY PARK EAST  
LOS ANGELES, CALIFORNIA 90067-3026

ORANGE COUNTY  
4 PARK PLAZA  
IRVINE, CALIFORNIA 92614-8557

SAN DIEGO  
750 B STREET  
SAN DIEGO, CALIFORNIA 92101-4605

SAN FRANCISCO  
ONE MONTGOMERY STREET, TELESIS TOWER  
SAN FRANCISCO, CALIFORNIA 94104-4505

DALLAS  
1717 MAIN STREET  
DALLAS, TEXAS 75201-7390

DENVER  
1801 CALIFORNIA STREET  
DENVER, COLORADO 80202-2641

WRITER'S DIRECT DIAL NUMBER

(202) 887-3678

BY HAND DELIVERY

Mr. William F. Caton  
Acting Secretary  
Federal Communications Commission  
1919 M Street, N.W., Room 222  
Washington, D.C. 20554

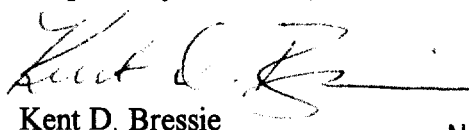
Re: Allocation and Designation of Spectrum for Fixed Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz, and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations, IB Docket No. 97-95

Dear Mr. Caton:

Please find enclosed for filing an original and nine copies of Teledesic Corporation's Reply Comments in the above-referenced proceeding.

Also included is an additional copy of this filing to be date-stamped and returned with our messenger. Please contact me if you have any questions regarding this matter.

Respectfully submitted,

  
Kent D. Bressie

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Enclosures

Before the  
FEDERAL COMMUNICATIONS COMMISSION  
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JUN - 3 1997

Federal Communications Commission  
Office of Secretary

*In the Matter of*

Allocation and Designation of Spectrum for Fixed Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz, and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations

IB Docket No. 97-95

**REPLY COMMENTS OF TELEDESIC CORPORATION**

Teledesic Corporation hereby replies to the initial comments filed by other parties regarding the 36.0-51.4 GHz band plan proposed in the *Notice of Proposed Rulemaking* in this docket.<sup>1</sup> The initial comments reiterated many of the points made by Teledesic in its initial comments regarding the difficulties and inefficiencies of band sharing. Laudably, the Commission sought to avoid many of these difficulties and inefficiencies by endorsing band segmentation in its proposed 36.0-51.4 band plan.

The *NPRM* and many of the initial comments discredit the idea of band sharing as an unqualified good. Notwithstanding some commenters' facile assumption that band sharing always maximizes efficiency or "make[s] the best possible use of the scarce spectrum and orbit

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<sup>1</sup> FCC 97-85 (rel. Mar. 24, 1997) ("*NPRM*").

resources,”<sup>2</sup> the record in this proceeding and the Commission’s experience in others both demonstrate that band sharing imposes costs and forces trade-offs among competing objectives in ways that band segmentation does not. Rather than limit systems from the outset, band segmentation would “allow[] each service to *independently optimize* the multiple trade-offs between coverage density, service quality, cost effectiveness and spectral efficiency.”<sup>3</sup>

In addition, a close reading of the initial comments on the *NPRM* reveals that the different band sharing issues raised by the Commission’s 36.0-51.4 GHz band plan are interrelated in ways that are not always appreciated. Both forms of band sharing at issue here—between non-geostationary (“NGSO”) and geostationary (“GSO”) satellite systems, and between high-density satellite and terrestrial systems—would impose the same kinds of technical and operational constraints and cost burdens. In addition, pursuit of either type of sharing can exacerbate the difficulty of achieving the other type of sharing. While it may be convenient for opponents of band segmentation to ignore the difficulty the Commission will have in choosing between such incommensurables later, the Commission surely knows that the day of reckoning will eventually arrive, and the problems then will be worse unless the Commission follows through with its segmentation plan now.

**I. Band Sharing Imposes Technical and Operational Constraints as well as Cost Burdens**

No commenter seriously contested the fact that band sharing—whether NGSO-GSO or satellite-terrestrial—constrains operational flexibility and technological innovation while imposing

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<sup>2</sup> Comments of SkyBridge L.L.C. (“SkyBridge”), IB Docket No. 97-95, at 3 (filed May 5, 1997).

<sup>3</sup> Comments of Advanced Radio Telecom, Inc. (“ART”), IB Docket No. 97-95, at 14 (filed May 5, 1997) (emphasis added). ART advocated band segmentation between satellite and terrestrial services, but its argument applies to band sharing generally.

cost burdens. Some commenters argued that band sharing was a technological possibility. Others advocated further study of band sharing. Nevertheless, none demonstrated persuasively that band sharing is a desirable and efficient means of allocating spectrum for the design and deployment of viable systems and services. The Commission should therefore continue to be guided by the principle of band segmentation in its allocation and designation of the 36.0-51.4 GHz band plan.

**A. The Commission Should Not Burden New Services by Requiring Band Sharing Between NGSO and GSO Satellite Systems**

Teledesic continues to endorse the Commission's proposal to allocate separate band segments for NGSO and GSO systems in the 36.0-51.4 GHz band. As Motorola indicated in its initial comments, "[i]ntroducing GSO systems into the same band [as NGSO systems] on a co-primary basis could significantly limit system capacity."<sup>4</sup> Only band segmentation will allow for optimal flexibility in system design and operation while avoiding preoccupation with frequency and operational coordination issues.

While Hughes and Lockheed Martin proposed to study further the possibility of NGSO-GSO sharing, nowhere did they state that such sharing is presently workable as a guiding principle for the Commission's 36.0-51.4 GHz band plan.<sup>5</sup> Hughes claimed that Motorola's M-Star application supports NGSO-GSO sharing.<sup>6</sup> As noted above, however, Motorola itself has recognized that NGSO and GSO band sharing would constrain its system. As for "further study,"

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<sup>4</sup> See Comments of Motorola Satellite Systems, Inc. ("Motorola"), IB Docket No. 97-95, at 8 (filed May 5, 1997).

<sup>5</sup> See Comments of Hughes Communications, Inc. ("Hughes"), IB Docket No. 97-95, at 19 (filed May 5, 1997) ("Hughes has long advocated the development and implementation of sharing criteria for NGSO systems that allow them to use the spectrum in a manner that does not preclude GSO systems in the same band."); Comments of Lockheed Martin Corp. ("Lockheed Martin"), IB Docket No. 97-95, at 13 (filed May 5, 1997) ("All realistic sharing possibilities should be explored . . . even where the details are currently unproved [sic] . . .").

<sup>6</sup> Hughes Comments, at 18 n.19.

it might lead to changes in the interference environment, but it might not. The *present* reality is that development of these frequencies is already under way, and if the Commission does not embrace segmentation now, the presence of incumbent licensees will seriously constrain the Commission's ability to manage the band responsibly. Hughes and Lockheed Martin are free to conduct as much further study of NGSO-GSO sharing as they wish. The Commission's experience with this issue, however, amply justifies adoption of the band segmentation proposal in the *NPRM*.<sup>7</sup>

One commenter—SkyBridge—did claim that GSO-NGSO sharing is possible right now. Indeed, SkyBridge claims that sharing is *always* possible if system designers are told to share.<sup>8</sup> But SkyBridge's argument proves too much. A given sharing scheme may be theoretically possible when examined from a purely technical perspective, while at the same time not being feasible when other factors are taken into consideration. For example, it has been argued that GSO systems can avoid interfering with NGSO systems—rather than the other way around—by requiring GSO operators to implement satellite diversity.<sup>9</sup> The GSO network would have to

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<sup>7</sup> Regardless of any past suggestion of NGSO-GSO sharing in Motorola's M-Star application, both Hughes and Lockheed Martin elsewhere cautioned that the Commission should hesitate to generalize from a single application. Lockheed Martin offered as one of its "basic principles" of spectrum management that "[t]he Commission's decision-making clearly does not proceed from an understanding of [the] fundamental and important differences [between satellite and terrestrial services] when it proposes to allocate spectrum based only on the requirements identified in a single pending satellite application." Lockheed Martin Comments, at 4. *See also* Hughes Comments, at 9 (arguing that the Commission should not base spectrum management decisions on a single pending application because it "simply does not reflect the breadth of the satellite industry's interest in the 40 GHz band or the wide range of satellite services that will be developing the 40 GHz band in the future."). The Commission should therefore refrain from assuming that NGSO-GSO band sharing is feasible on the basis of a single proposed system.

<sup>8</sup> SkyBridge Comments, at 3.

<sup>9</sup> CPM-97 Report § 4.4.1.1.3 (adopted 16 May, 1997 at the International Telecommunications Union's Conference Preparatory Meeting)

deploy two (or more) GSO satellites at sufficiently different longitudes (orbital slots) to serve the same regions. Each GSO Earth station would need to be equipped with two (or more) fixed antennas (or a much more expensive steerable antenna) so that it could be served by either (any) of the GSO satellites. The GSO network would be required to maintain information about the NGSO satellite orbits and to predict in advance whenever an NGSO satellite would cross near the line connecting one of the GSO satellites with a particular location on Earth. At such a time, the GSO Earth stations close to that location would have to stop communications with the original GSO satellite and begin use of an alternate GSO satellite. The GSO satellites would need to maintain communications between themselves via inter-satellite links so that messages could be routed to the Earth stations via an alternate satellite in the network. In this way, the GSO network could theoretically serve its users while avoiding interference to and from an NGSO network. Although theoretically possible, a GSO system would likely be considered *not feasible* if it were constrained by all these requirements to enable sharing with an NGSO system.

The fact that this scheme for GSO-NGSO sharing is in some sense “technically feasible” shows just how wrong it is to assume that band sharing should be imposed whenever it is “technically feasible.” Band sharing should not be imposed, for example, when it will increase the cost of a particular service so much that it threatens the economic viability of an entire service, or makes that service unaffordable for the people who need it most. Similarly, there is nothing “optimal,” “spectrum-efficient,” or even sensible about an obsessive pursuit of sharing that results in a lower-quality service that no one particularly wants or needs. Satellite and other communications systems should not be designed with the overriding requirement being to share spectrum with other types of systems no matter what, but rather to provide a highly valuable and

affordable service to the public. They should be designed to satisfy a real market need, like bridging the gap between those who currently enjoy access to advanced communications technologies and those who do not. The Commission's proposed segmentation of the 36-51.4 GHz band will permit system designers to develop systems that meet real needs rather than some misguided technical abstraction.

**B. The Commission Should Not Burden New Services By Imposing Band Sharing Between High-Density Satellite and Terrestrial Systems**

Many commenters joined Teledesic in endorsing the Commission's proposal to segment satellite and terrestrial systems into separate bands.<sup>10</sup> TIA, Alcatel, ART, and WinStar noted that band sharing poses interference problems that would allow co-frequency operation only under strict operating constraints.<sup>11</sup> TIA (with Alcatel's endorsement) pointed out that band sharing simply will not work when satellite and terrestrial systems use similar elevation angles. "Satellite and terrestrial FS users deploy many systems in urban areas. Both systems could implement paths with high elevation angles. These considerations make frequency band sharing impractical."<sup>12</sup> Sharing between satellite and terrestrial systems therefore constrains both kinds of systems, to the benefit of neither.

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<sup>10</sup> See Comments of Teledesic Corp., IB Docket No. 97-95, at 3-5 (filed May 5, 1997); Comments of Alcatel Network Systems, Inc. ("Alcatel"), IB Docket No. 97-95, at 2 (filed May 5, 1997) (endorsing TIA's support for the Commission's decision "to eliminate unnecessary or impractical band sharing", including band segmentation for satellite and terrestrial systems) (filed May 5, 1997; ART Comments, at 13-14; Comments of the Telecommunications Industry Association ("TIA"), IB Docket No. 97-95, at 13-14 (filed May 5, 1997); Comments of WinStar Communications, Inc. ("WinStar"), IB Docket No. 97-95, at 3-4 (filed May 5, 1997); Comments of Biztel, Inc., IB Docket No. 97-95, at 5-6 (filed May 5, 1997).

<sup>11</sup> See TIA Comments, at 14; Alcatel Comments, at 2 (endorsing TIA's position); ART Comments, at 13-14; WinStar Comments, at 4 (noting that "severe operating constraints" would preclude satellite-terrestrial band sharing).

<sup>12</sup> TIA Comments, at 14; Alcatel Comments, at 2 (endorsing TIA's position).

As with NGSO-GSO sharing, some of the commenters—including TRW and Lockheed Martin—suggested that satellite-terrestrial sharing merits further study.<sup>13</sup> As discussed above, however, the “further study” proponents have failed to show how band sharing enhances the Commission’s spectrum management and public interest objectives.

Motorola and SkyBridge touted their proposed systems—M-Star and SkyBridge, respectively—as existing evidence that satellite-terrestrial sharing is feasible.<sup>14</sup> Yet the technical validity of their claims have been questioned and certainly have not been proven. Even if they were able to demonstrate that satellite-terrestrial sharing is a technical possibility, it does not prove that systems designed for satellite-terrestrial sharing will use spectrum more efficiently, enhance coverage density, provide higher quality service, or result in cheaper systems which ultimately reduce the cost to users. While the increased complexity associated with systems designed to share with other services may benefit communications equipment manufacturers, it is likely that this would result in higher cost and poorer quality of service to the public.

## **II. Band Sharing Can Limit Other Forms of Band Sharing**

Band sharing not only constrains operational flexibility and technological innovation; it also limits band sharing itself. Band sharing premised on certain system architectures and other technological features will, by design, preclude, other forms of band sharing inconsistent with those architectures and features.

For example, the particular sharing methodology recommended by SkyBridge—satellite diversity—would pose the same sort of interference problems cited by Alcatel and TIA as reasons

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<sup>13</sup> See Comments of TRW, Inc. (“TRW”), IB Docket No. 97-95, at 15-16 (filed May 5, 1997); Lockheed Martin Comments, at 13.

<sup>14</sup> See Motorola Comments, at 18-19; SkyBridge Comments, at 3-4.



for adopting band segmentation. SkyBridge has proposed an NGSO system designed to share with GSO systems. To permit such sharing, SkyBridge would rely on

switching off spot-beams to avoid potential interference situations, and using a specific waveform, including spreading, to limit power flux densities. These and other steps ensure that the power levels contributed by SkyBridge to any GSO or terrestrial system will be well below the noise floor of the receivers of such systems. As a result, the SkyBridge System can operate co-frequency and co-coverage with GSO and terrestrial systems.<sup>15</sup>

SkyBridge's proposal, however, relies on low elevation angle operation (as low as 5 degrees for gateway's and professional terminals and 10 degrees for standard user terminals). Yet the low elevation angles proposed by SkyBridge only aggravate the difficulties of sharing between satellite and terrestrial systems. As TIA *and Alcatel* pointed out, when satellite and terrestrial systems both use similar elevation angles, harmful interference results.<sup>16</sup> SkyBridge's position is therefore inconsistent because (according to its parent, Alcatel) its proposed system could not, in fact, "operate co-frequency and co-coverage with GSO *and* terrestrial systems."<sup>17</sup> SkyBridge's situation reveals the enormous technical hurdles to be overcome by systems premised on band sharing. By contrast, systems developed under a regime of band segmentation can avoid this coordination preoccupation altogether. The Commission should therefore adopt band segmentation in the frequencies under consideration.

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<sup>15</sup> *Id.*, at 4.

<sup>16</sup> TIA Comments, at 14; Alcatel Comments, at 2 (endorsing TIA's position).

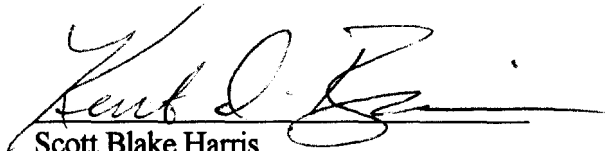
<sup>17</sup> See SkyBridge Comments, at 4 (emphasis added).

## CONCLUSION

For the reasons set forth above and in Teledesic's initial comments, the Commission should adopt a 36.0-51.4 GHz band plan providing for band segmentation between NGSO and GSO satellite systems and between satellite and terrestrial systems. Only with band segmentation will the Commission be able to avoid the frequency and operational problems inherent in band sharing, which would otherwise constrain operational flexibility and technological innovation necessary for viable systems and services.

Respectfully submitted,

TELEDESIC CORPORATION



Scott Blake Harris

Mark A. Grannis

Kent D. Bressie

GIBSON, DUNN & CRUTCHER, LLP

1050 Connecticut Avenue, N.W.

Washington, D.C. 20036

(202) 955-8500

*Its Attorneys*

WL971530.060/3+

## **CERTIFICATE OF SERVICE**

I, Kent D. Bressie, do hereby certify that a copy of the foregoing Reply Comments of Teledesic Corporation have been sent, via hand delivery (\*) or first class mail, postage prepaid, on this 3rd day of June, 1997 to the following:

**\*Peter Cowhey, Chief**  
International Bureau  
Federal Communications Commission  
Room 800, Stop Code 0800  
2000 M. Street, N.W.  
Washington, D.C. 20554

**\*John Stern, Senior Legal Advisor**  
International Bureau  
Federal Communications Commission  
Room 800, Stop Code 0800  
2000 M Street, N.W.  
Washington, D.C. 20554

**\*Cassandra Thomas, Deputy Chief**  
Satellite and Radiocommunications Division  
International Bureau  
Federal Communications Commission  
Room 800, Stop Code 0800B  
2000 M Street, N.W.  
Washington, D.C. 20554

**\*Fern Jarmulnek, Chief**  
Satellite Policy Branch  
International Bureau  
Federal Communications Commission  
Room 500, Stop Code 0800B3  
2000 M Street, N.W.  
Washington, D.C. 20554

**\*Ruth Milkman, Deputy Chief**  
International Bureau  
Federal Communications Commission  
Room 800, Stop Code 0800  
2000 M. Street, N.W.  
Washington, D.C. 20554

**\*Thomas Tycz, Chief**  
Satellite and Radiocommunications Division  
International Bureau  
Federal Communications Commission  
Room 800, Stop Code 0800B  
2000 M Street, N.W.  
Washington, D.C. 20554

**\*Karl A. Kensinger**  
International Bureau  
Federal Communications Commission  
Room 514  
2000 M Street, N.W.  
Washington, D.C. 20554

**\*Rosalee Chiara, Deputy Chief**  
Satellite Policy Branch  
International Bureau  
Federal Communications Commission  
Room 516  
2000 M Street, N.W.  
Washington, D.C. 20554

\*Steve Sharkey, Chief  
Satellite Engineering Branch  
International Bureau  
Federal Communications Commission  
Room 500, Stop Code 0800B1  
2000 M Street, N.W.  
Washington, D.C. 20554

W. Theodore Pierson, Jr.  
Pierson & Burnett, L.L.P.  
1667 K Street, N.W.  
Suite 801  
Washington, D.C. 20006  
*On behalf of Advanced Radio Telecom Corp.*

Walter H. Sonnenfeldt  
Walter Sonnenfeldt & Associates  
4904 Ertter Drive  
Rockville, MD 20852  
*On behalf of Biztel, Inc.*

Philip V. Otero  
Vice President and General Counsel  
GE American Communications, Inc.  
Four Research Way  
Princeton, N.J. 08540

Scott B. Tollefsen  
Vice President, General Counsel  
and Secretary  
Hughes Communications, Inc.  
1500 Hughes Way  
Long Beach, CA 90810

Timothy E. Welch  
Hill & Welch  
1330 New Hampshire Ave., N.W.  
Suite 113  
Washington, D.C. 20036  
*On behalf of ICE-G, Inc. d/b/a International  
Communications Electronics Group*

\*Jennifer Gilsenan  
International Bureau  
Federal Communications Commission  
Room 511  
2000 M Street, N.W.  
Washington, D.C. 20554

Robert J. Miller  
Gardere & Wynne, L.L.P.  
1601 Elm Street  
Suite 3000  
Dallas, TX 75201  
*On behalf of Alcatel Network Systems, Inc.*

Arthur Firstenberg  
Chairman, Cellular Phone Taskforce  
Post Office Box 100404  
Vanderveer Station  
Brooklyn, N.Y. 11210

Peter A. Rohrbach  
Hogan & Hartson L.L.P.  
555 Thirteenth Street, N.W.  
Washington, D.C. 20004  
*On behalf of GE American  
Communications, Inc.*

Gary M. Epstein  
Latham & Watkins  
1001 Pennsylvania Ave., N.W.  
Suite 1300  
Washington, D.C. 20004  
*On behalf of Hughes Communications, Inc*

Gerald Musarra  
Senior Director  
Commercial Policy and Regulatory Affairs  
Space and Strategic Missiles Center  
Lockheed Martin Corporation  
1725 Jefferson Davis Highway  
Arlington, VA 22202

Michael D. Kennedy  
Vice President and Director  
Satellite Regulatory Affairs  
Motorola, Inc.  
1350 I Street, N.W., Suite 400  
Washington, D.C. 20005

Richard D. Parlow  
Associate Administrator  
Office of Spectrum Management  
United States Department of Commerce  
National Telecommunications and  
Information Administration  
Washington, D.C. 20230

Phillip L. Spector  
Paul, Weiss, Rifkind,  
Wharton & Garrison  
1615 L Street, N.W.  
Suite 1300  
Washington, D.C. 20036  
*On behalf of SkyBridge L.L.C.*

Robert J. Miller  
Gardere & Wynne, L.L.P.  
1601 Elm Street  
Suite 3000  
Dallas, TX 75201  
*On behalf of Telecommunications  
Industry Association*

Timothy R. Graham  
WinStar Communications, Inc.  
1146 19th Street, N.W.  
Washington, D.C. 20036

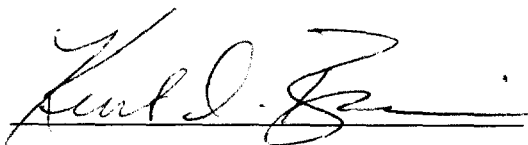
Philip L. Malet  
Steptoe & Johnson LLP  
1330 Connecticut Avenue, N.W.  
Washington, D.C. 20036  
*On behalf of Motorola, Inc.*

Lon Levin  
Co-Chair  
Satellite Industry Association  
225 Reinekers Lane  
Suite 600  
Alexandria, VA 22314

Denis Couillard, Chairman  
Telecommunications Industry Association  
2500 Wilson Boulevard  
Suite 300  
Arlington, VA 22201

Norman P. Leventhal  
Leventhal, Senter & Lerman, P.L.L.C.  
2000 K Street, N.W.  
Suite 600  
Washington, D.C. 20006  
*On behalf of TRW, Inc.*

Philip L. Verveer  
Willkie Farr & Gallagher  
Three Lafayette Centre  
1155 21st Street, N.W.  
Washington, D.C. 20036  
*On behalf of WinStar Communications, Inc.*



Kent D. Bressie